

Cool Chips plc

Cool Chips™

Markets

Electronics Cooling

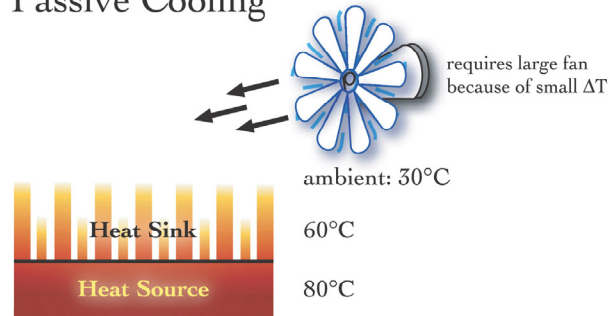


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Active vs. Passive Cooling

Passive Cooling



Heat source runs hot, and can never be anything colder than ambient.



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Passive cooling technologies, like heat sinks, heat pipes, and fans, are well known, and very useful for moving heat. They are, however, basically limited in what they can achieve. The heat source (the processor) cannot be any colder than ambient, and even operating below 100°C strains the capability of passive heat sinks.

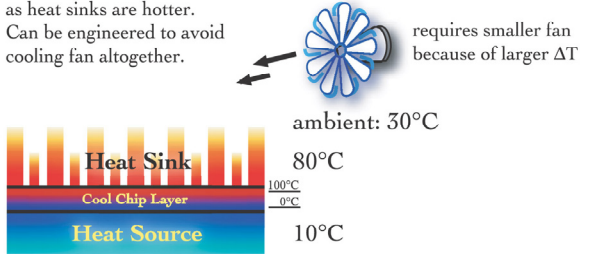
Cool Chips™ is an active cooling technology, which can incorporate passive systems, but also has special benefit.

The example is for a typical electronics cooling system such as might be found in a computer or in an electronics package in your car.

Active vs. Passive Cooling

Active Cooling

Less cooling air required, as heat sinks are hotter. Can be engineered to avoid cooling fan altogether.



requires smaller fan because of larger ΔT


ambient: 30°C

Heat Sink 80°C

Cool Chip Layer 100°C

Heat Source 10°C

Heat source runs cold, and can be much colder than ambient, allowing for faster speeds, higher reliability, denser packaging.



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With an active cooling solution, the following benefits accrue:

- 1: The chip can run hotter, without raising the junction temperature, by dumping the heat to the Cool Chip layer which keeps the cold side nears 0°C.
- 2: Because the hot heat sink can be run at an elevated temperature, it can dissipate more heat using the same area. In other words, a hotter heat sink can be smaller. The same is true for the amount of air flow required.

3: A colder chip is more reliable, and can be clocked to run faster. Cool Chips™ can greatly reduce chip failures.

4: Once Cool Chips™ are established as the cooling solution, the processor designer's job becomes much simpler. He does not have to worry about dissipating heat to a hot heat sink -- instead he has the far easier job of getting heat to a cold plate mounted on the processor.

Cool Chips™ Market Analysis

Electronics Cooling

Electronic packages are increasingly ubiquitous, and they run hot. There is a tremendous need for an active, compact and reliable cooling system.

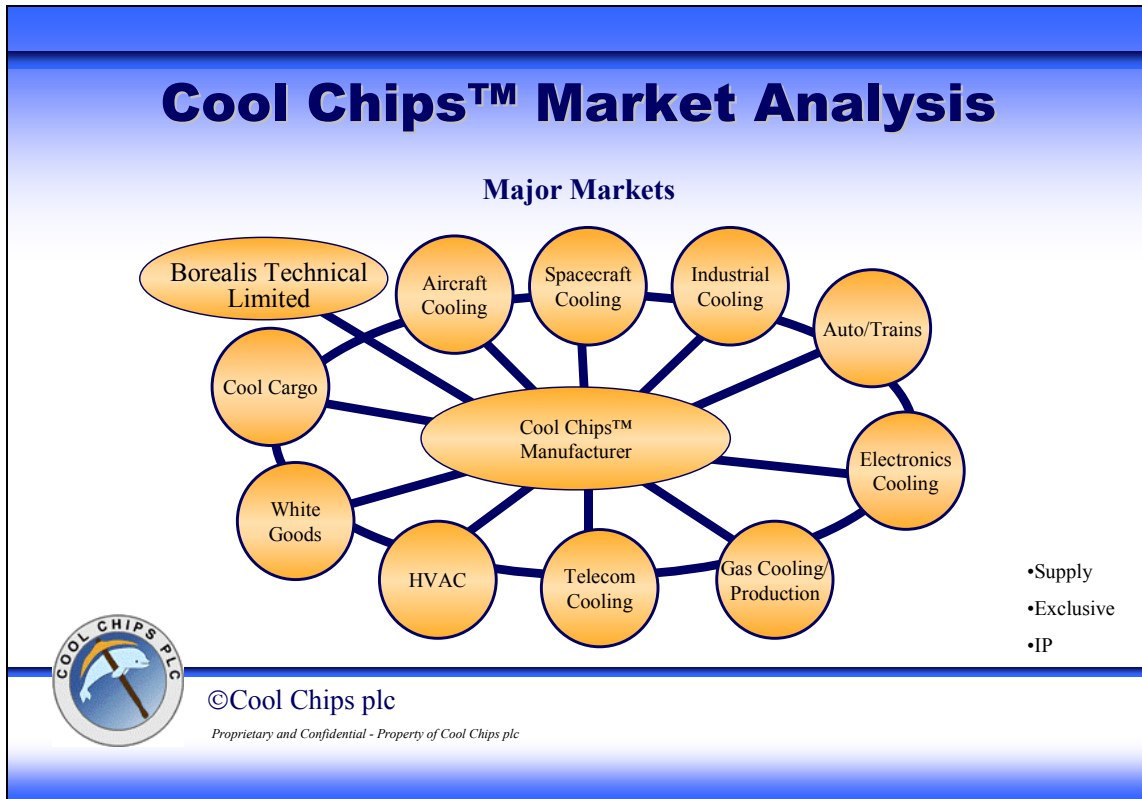
Cool Chips allow for:

- **Increased reliability and processor speeds**
 - As an active solution, electronics can be kept at a fixed, below-ambient, temperature
 - Due to high power cooling, packaging can be tighter while requiring less thermal design time and packaging investment
- **Modular cooling design**
 - With a cross-section of 1 cm², Cool Chips can be applied and operated in a totally modular fashion



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Each of the niches named above has present sales -- for cooling and thermal management -- in excess of \$1 billion yearly.

Borealis is contractually committed to exclusively licensing a given market niche to only one company, so that company retains worldwide exclusive rights to apply Cool Chips to their market. The company would have the right to sub-license the technology in turn.

In turn, that company will be supplied by a manufacturer. Since Cool Chips™ are designed to be compatible with existing semiconductor processes, the manufacturer is likely to be a major semiconductor company.

The manufacturer ships Cool Chips™ (either packaged or unpackaged) to the licensee for a given niche. That licensee then completes the packaging and integration necessary to fold the

Cool Chip™ component into the product, which is then sold into the marketplace.

In this way, every company is involved by doing what they already do best-- the manufacturer manufactures chips. The licensees assemble and sell product from delivered components.

At the same time, each licensee has an exclusive niche, and cannot, by definition, compete with any of the other companies in the Club. That means that sharing information within the Club presents no competitive disadvantage.

Borealis' role in the process is as a facilitator, to ensure that information flow remains for all the niches, and that intellectual property is shared between all the licensees, so that each can benefit from the pooled research efforts of the entire Club.

Fabrication Cost

Cool Chips™ is a chip-based technology, with precise, but simple construction.

- Non-exotic materials with moderate contamination tolerance
- No costly materials involved in processes
- Very small devices require small amounts of material

Marginal cost of Cool Chips™, in production, could be as low as pennies per watt capacity



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In addition to high efficiency, Cool Chips™ are expected to be very inexpensive to make.

A number of factors come into play when estimating the cost of a product like a turbine or a compressor. The marginal costs (the cost of making one more unit on an already-present assembly line), are heavily dependent on the following factors:

1: Materials quantity. No device can cost less than its parts. And big, heavy machines like turbines and compressors have a lot of steel, copper and iron in them. This is an unavoidable cost. Cool Chips™ use very little in the way of raw materials -- at least an order of magnitude less than the competition. A single chip, capable of 100 watts of cooling, will measure less than 1 cm on a side, and be only a few millimeters thick.

2: Material quality. As machines improve, the specifications for their components become ever-more demanding. If the components must be of very high materials purity, a significant cost is added. This cost, unlike, say economies of scale, is not reduced easily. The price of 99% pure iron is far less than 99.9999% pure iron. Cool Chips™ can use relatively impure materials.

3: Machining/assembly costs. The more welding, bonding, sealing, etc. which is required, the higher the costs as well. Cool Chips™ are extremely simple to manufacture -- much less complicated than an Intel 386 processor, for example.

4: Component costs. The more pieces have to be put together, the more it will cost. Cool Chips™ have a very small component count, much less than competing technologies.

The Big Picture

Cool Chips™ are projected to be a high margin, high volume product which is:

- ... In demand in dozens of industries
- ... Superior to all other existing and projected technologies
- ... Proprietary, allowing a 20 year head start
- ... Environmentally Friendly



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Cool Chips Corporate Overview

Cool Chips plc

- Gibraltar Company Number 57885
- Incorporated 23 April 1996
as Borealis Cool Manufacturing Limited
- Name change to Cool Chips Limited 1 June 2000
- Re-registered as public limited company 27 July 2000

Publicly traded (Pinksheets: COLCF)

- Capital Authorized and Outstanding: 10 million shares
- About 350 shareholders; >70% owned by Borealis Exploration Limited
- Fully audited reporting



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